

A Comparative Study on the Chest CT Scan Radiological Findings and Hematological Parameters of COVID-19 and NON-COVID-19 Pneumoniapatients in Al-Yarmouk Teaching Hospital in Baghdad, Iraq

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Abstract

Background: Chest CT scan has a great sensitivity with rapid diagnoses of COVID-19 infection in the community. Nevertheless, the specificity of this test for diagnosis of this disease are believed to be low.

Objective: To evaluate role, effectiveness and diagnostic accuracy of chest CT scan with main imaging manifestations and hematological appearances for screening COVID-19 cases through comparing results of those with other NON-COVID-19 pneumonia.

Patients and Method: Twenty COVID-19 & 28NON-COVID-19pneumoniaIraqi patients in Yarmouk teaching hospital, Baghdad, Iraq from 1 march to 1 may 2020, at the beginning of the outbreak in Iraq COVID-19 had been included in current research. Confirmed COVID-19 together with NON-COVID-19 patients to be infected or not with SARS-CoV-2 using RT-PCR were included in current research. Socio-demographic, hematological and chest CT scan finding were examined to compare the variance between COVID-19 and NON-COVID-19 patients.

Result: “COVID-19” patients mean age was 62.10 ± 14.308 SD ranged between 35- 90 years whereas “non-COVID-19” patients mean was 61.07 ± 13.638 SD. There was a significant difference between WBC average number of COVID-19 compared to its average number of “NON-COVID-19” patients ($P < 0.001$). A significant differences between Neutrophils, lymphocytes, Monocytes, Eosinophil and Basophils low counts and MCV, MCH, PDW of COVID-19 compared to its counts or levels in “NON-COVID-19” patients ($P < 0.001$). A significantly different of CT scan Images ‘Ground glass opacity, Crazy paving alteration’, ‘Vascular dilatations, Traction Bronchiectasis alteration’, ‘Sub pleural –bands’ & Architectura) between “COVID-19” & ”NON-COVID-19 cases (P less than 0.001), whereas Consolidation was non-significant.

Conclusion: A chest CT scan might be a dependable tool for COVID-19 cases diagnosis. Hematological features that include WBC, Neutrophils, Lymphocytes, Monocytes, Eosinophil, Basophils, MCV, MCH, PDW might be substantial indications for COVID-19 appraisal.

Keywords: COVID-19, NON-COVID-19, Pneumonia, CT scan, Hematological test, case-control study.

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Introduction

«Coronavirus» interactive «disease-2019» (COVID-19) is a pandemic outbreak produced by «severe acute respiratory syndrome» coronavirus-2 (SARS-CoV-2. It begins suddenly in December 2019

in ‘Wuhan’ City, ‘China’, then spread in 213 countries characterized by a minor common cold-like sickness, to ‘severe viral- pneumonia’ might develop to ‘acute-respiratory-distress-syndrome’ that is possibly lethal¹⁾.

RT-PCR sensitivity might be lower than 50% & certain diagnoses might be lost. Low sensitivity In ‘COVID 19’ early stage, the results of this test may take more than 24 hours, while the results of a CT scan are available immediately²⁾. RT-PCR test for SARS-CoV-2 viral RNA recognition is very specific but low sensitive³⁾ as greatest of COVID-19 cases with duplication negative results. Chest CT scan lung findings are appear than clinical manifestations, which make Chest CT scan critical for runs and accurate diagnosis⁴⁾. So, CT scan might be applied as an supplementary diagnostic tool simultaneously in COVID-19 diagnosis²⁾.

Chest CT scans has high sensitivity with low specificity in COVID-19, so it is problematic to differentiate COVID-19 from non-COVID-19 pneumonia cases^{5,6)}. Nevertheless, RT-PCR appear as negative results, while their CT imaging findings were abnormal as reported in certain study^{7,8,9,10)} Through using of chest CT scan findings with RT-PCR, the sensitivity could be reach to 99%, so chest CT scan should be used as a reference for COVID-19 diagnosis⁶⁾.

Chinese studies related to COVID-19 showed that there is a decrease in white blood cells in hospital patients, with varying degrees of decrease in lymphocytes with a relative decrease in platelets¹¹⁾.

In Iraq, as far as we know, no previous study has yet compared chest CT scan and hematological investigation results between COVID-19 & non-COVID-19 viral pneumonia kinds. Thus, this study was the first research to compare chest CT scan findings & hematological features of COVID-19 & non-COVID-19 viral pneumonia kindsto know diagnostic efficacy of these tools in COVID-19 diagnosis.

Patients and Method

Prospective case-control design was used to identify the role, effectiveness and diagnostic accuracy of hematological tests with a chest CT scan for screening and rapid diagnosis of COVID-19 infections through compared the difference of Hematological tests and radiographic features results of “COVID-19” & ”NON-COVID-19” viral pneumonia kinds. Twenty “COVID 19” together with pneumonia patients 28 other” NON-

COVID-19” were confirmed simultaneously to be infected or not infected with SARS-CoV-2 respectively using RT-PCR & blood as a suitable specimen in Yarmouk teaching hospital, Baghdad, Iraq from 1 march to 31 April 2020, at the beginning of the outbreak in Iraq COVID-19. We analyzed the demographic, compare the pulmonary CT scan findings and hematological investigation among ”COVID-19” & NON-COVID-19 Iraqi patients. Anbar medical College approved the protocol. All patients provided informed consent for participation in the study.

Statistical Analyses: Data were analyzed using IBM SPSS software version 22. The results were presented in tables as frequencies and percentages. Chi-Square test was used to compare between the variables through cross-tabulations and P-Value less than 0.05 considered a statistically significant difference

Results

Twenty COVID-19 confirmed cases with 28 chest pain non-COVID-19 cases (as a control) were enrolled in the study.

‘COVID-19’ patients mean age was 62.10 ±14.308SD ranged between 35 months and 90 years whereas ‘non COVID-19’ patients mean age was 61.07± 13.638 SD, Age group had been categorized as following: ≤ 43 (2, 10.0%); 44 – 59 (5, 25%); 60 – 74 (9, 45.0%) and 75+ years (4, 20.0%), (11, 55.0%) and (9, 45.0%) were male and female respectively. Fifteen (75.0%) of COVID-19 patients were identified during March and others 5 (25.0%) identified during April 2020.

Table 1: Epidemiological characteristics of COVID-19 confirmed Patient diagnosed in Al-Yarmouk teaching hospital, Baghdad, Iraq

Character	Frequency (%) (N. 20)
Mean of age	62.10 ±14.308 SD
Gender	
Male	11 (55.0%)
Female	9 (45.0%)
Incidence in month	
March	15 (75.0%)
April	5 (25.0%)
Age group	
≤ 43	2 (10.0%)
44 – 59	5 (25%)
60 – 74	9 (45.0%)
75+	4 20.0%

Normal WBC average number (6.480/mcL in COVID-19 (20 [41.7%]) compare with elevation of WBC average number (10.193/mcL) (28 [58.3%]) of NON-COVID-19 patients, significant difference of WBC average number of COVID-19 compare withNON-COVID-19 cases(P<0.001).

Lymphocytes were decreased in COVID-19(20[41.7%]) compare with NON-COVID-19 patients(P<0.001)(28 [58.3%]).

Decreased count or levels of Neutrophils, lymphocytes, Monocytes, Eosinophil and Basophils was observed in COVID-19 (4.500/mcL), (1.330/mcL) (0.350), (0.075) (0.035) respectively Compared to (6.679/mcL), (2.154/mcL), (0.782)(0.429), 0.150) respectively of NON-COVID-19 patients. A significant difference among Neutrophils, lymphocytes, Monocytes, Eosinophil and Basophils low levels of COVID-19 Compared to its counts in NON -COVID-19 patients(P<0.001).

Abnormally decreased Mean Corpuscular Volume

(MCV) and corpuscular Hemoglobin (MCH) were seen in COVID-19 patients (85.360fL), (28.520pg) respectively Compared to its Mean (89.061fL), (29.939pg) respectively in NON-COVID-19 patients. A significant difference among decrease mean MCV and MCH of COVID-19 compared to its Mean in NON-COVID-19 patients (P<0.001) (Table 3).

Abnormally increased Platelet Distribution Width (PDW) was seen in COVID-19 patients (17.762%) compared to its percent (15.896%) in 'non-COVID-19' patients, a significant difference among increase PDW of COVID-19 Compared to its percent in NON-COVID-19 patients(P<0.001) (Table 3).

Whoever, non-significant difference amongst level of RBCs (P. Value 0.474), 'hemoglobin' (P. Value 0.135), 'Hematocrit-test' (P. Value 0.060), 'Platelets Count' (P. Value 0.121), 'mean platelet volume' (P. Value 0.710) & PCT levels (P. Value 0.372) of 'COVID-19' & 'non-COVID-19' patients.

Table 2: Statistical comparisons different among' COVID-19' & NON-COVID-19 (as Control) hematological parameters

Parameter	Confirmed COVID-19, NON-COVID-19 cases (Total No.48)	N	Mean	Std. Deviation	Std. Error Mean	P-value
WBCcount	COVID-19	20	6.480	2.1910	0.4899	0.000
	Non-COVID-19	28	10.193	3.8400	0.7257	
Neutrophils	COVID-19	20	4.500	2.0532	0.4591	0.002
	Non-COVID-19	28	6.679	2.4524	0.4635	
Lymphocytes	COVID-19	20	1.330	0.4566	0.1021	0.002
	Non-COVID-19	28	2.154	1.0500	0.1984	
Monocytes	COVID-19	20	0.350	0.0889	0.0199	0.000
	Non-COVID-19	28	0.782	0.2653	0.0501	
Eosinophil	COVID-19	20	0.075	0.0786	0.0176	0.000
	Non-COVID-19	28	0.429	0.3516	0.0664	
Basophils	COVID-19	20	0.035	0.0489	0.0109	0.008
	Non-COVID-19	28	0.150	0.1816	0.0343	
RBC level	COVID-19	20	4.6215	0.78433	0.17538	0.474
	Non-COVID-19	28	4.7571	0.51742	0.09778	
HB	COVID-19	20	12.640	1.9749	0.4416	0.135
	Non-COVID-19	28	11.843	1.6428	0.3105	
Hematocrit test	COVID-19	20	39.605	6.1581	1.3770	0.060
	Non-COVID-19	28	42.946	5.7403	1.0848	

Parameter	Confirmed COVID-19, NON-COVID-19 cases (Total No.48)	N	Mean	Std. Deviation	Std. Error Mean	P-value
MCV	COVID-19	20	85.360	4.0512	0.9059	0.024
	Non-COVID-19	28	89.061	6.1818	1.1683	
MCH	COVID-19	20	28.520	2.0943	0.4683	0.020
	Non-COVID-19	28	29.939	1.9547	0.3694	
Platelet Count	COVID-19	20	188.80	53.211	11.898	0.121
	Non-COVID-19	28	217.11	66.143	12.500	
PCT	COVID-19	20	.1315	0.03183	0.00712	0.372
	Non-COVID-19	28	.1243	0.02364	0.00447	
Mean platelet volume	COVID-19	20	7.429	0.6587	0.1473	0.710
	Non-COVID-19	28	7.539	1.1970	0.2262	
PDW	COVID-19	20	17.762	0.8898	0.1990	0.000
	Non-COVID-19	28	15.896	0.5189	0.0981	

A Chest CT scan of COVID-19 patients with NON-COVID-19 patients had been shown in Figure 1,2,3 and Table 3.

Ground glass was present in 17/20 patients (85.0%) in COVID-19 confirmed cases, in 9/28 patients (32.1%) in NON-COVID-19 cases. Crazy paving was present in 15/20 patients (75.0%) in COVID-19 confirmed cases and only in 2/28 patients (7.1%) in Chest pain Unconfirmed COVID-19 cases. A significant difference was observed between the COVID-19 confirmed cases and Chest pain NON- COVID-19 cases regarding the ground glass and Crazy paving alteration (P Value= 0.000) Table 3.

Vascular dilatation was present in 12/20 patients (60.0%) in COVID-19 confirmed cases and only in 2/28 patients (7.1%) in Chest pain unconfirmed COVID-19 cases. Traction Bronchiectasis was present in 11/20 patients (55.0%) in COVID-19 confirmed cases and only in 3/28 patients (10.7%) in Chest pain unconfirmed COVID-19 cases. Subpleural bands and Architectural were present in 10/20 patients (50.0%) in COVID-19 confirmed cases and only in 3/28 patients (10.7%) in

Chest pain unconfirmed COVID-19 cases Significant difference was observed between the COVID-19 confirmed cases and Chest pain unconfirmed COVID-19 cases regarding the Vascular dilatation, Traction Bronchiectasis alteration and Subpleural bands and Architectural (P Value= 0.000) Table 3.

Consolidation was present only in 4/20 patients (20.0%) in COVID-19 confirmed cases and only in 15/28 patients (53.6%) in Chest pain unconfirmed COVID-19 cases, non- significant difference had been observed between the COVID-19 confirmed cases and Chest pain unconfirmed COVID-19 cases regarding the Consolidation alteration (P Value= 0.035) Table 3.

Ground -glass opacity, Crazy- paving alteration, wide Vascular- dilatation, Traction-Bronchiectasis alteration, Sub -pleural-bands & Architecture finding of Chest CT the were significantly associated with COVID-19 pneumonia, whereas Consolidation was not significantly associated with COVID-19 pneumonia (P<0.001), so chest CT scan can be documented as a preliminary diagnostic tool of COVID .

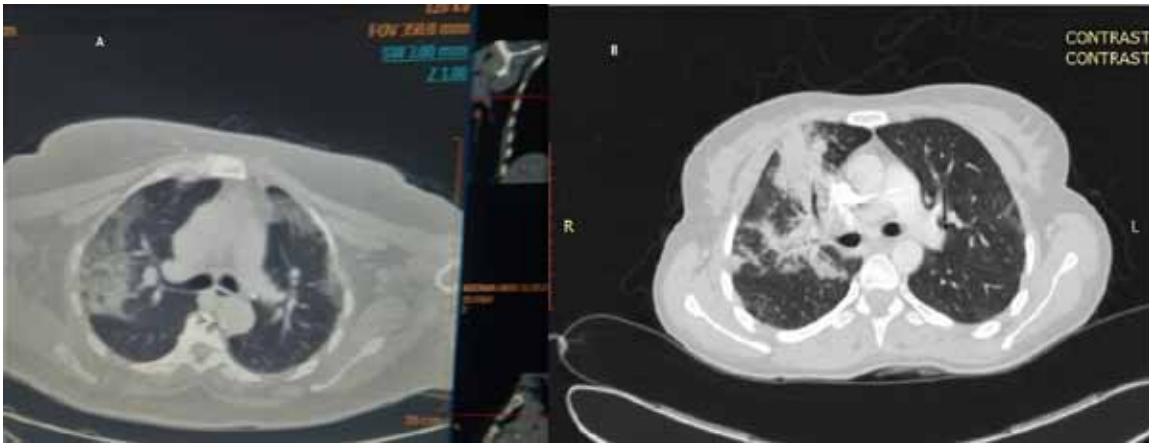


Figure 1: A. COVID-19 positive CT picture of the crazy paving pattern, B. Segmental consolidation in a patient with severe chest infection COVID-19 negative patient



Figure 2: A. Typical diffuse ground glass appearance with bilateral pleural effusion in COVID-19 positive patient, B. Nodular ground-glass pneumonitis with left pleural effusion COVID-19 negative patient.



Figure 3: A. Typical septal thickening with ground glass appearance in COVID-19 positive patient, B. Septal thickening and tree in bud pattern of trans-bronchial spread COVID-19 negative patient.

Table 3: Statistical comparisons of different chest CT scan Radiological diagnostic features, lesions and imaging manifestations among COVID-19 confirmed cases & NON-COVID-19 (Control).

Character	COVID-19 confirmed cases (N=20), frequency (%)	NON-COVID-19 cases (Control) (N=28), frequency (%)	P. value
Ground glass			
Positive feature	17 (85.0%)	9 (32.1%)	0.000
Negative feature	3 (15.0%)	19(67.9%)	
Crazy paving			
Positive feature	15(75.0%)	2(7.1%)	0.000
Negative feature	5(25.0%)	26(92.9%)	
Vascular dilatation			
Positive feature	12 (60.0%)	2 (7.1%)	0.000
Negative feature	8(40.0%)	26 (92.9%)	
Traction Bronchiectasis			
Positive feature	11(55.0%)	3 (10.7%)	0.001
Negative feature	9(45.0%)	25(89.3%)	
Sub pleural bands and Architectural			
Positive feature	10(50.0%)	3 (10.7%)	0.003
Negative feature	10(50.0%)	25(89.3%)	
Consolidation			
Positive feature	4 (20.0%)	15 (53.6%)	0.035
Negative feature	16 (80.0%)	13 (46.4%)	

Discussion

The current research aimed to show chest CT scan findings variance among COVID-19 & non-COVID-19 patients .

Current study revealed that chest CT scans can distinguish between COVID-19 from non-COVID-19 patients with in elevation specificity with a moderate sensitivity. This results had been agreement with the result reported by Bai et al. 2020¹².

The current study indicated that 85.0% of COVID19 showed initial abnormal CT scan findings, which

supports the possibility of CT scan as an assisting diagnostic tool in addition to RT- PCR for COVID19 diagnosis. Most common CT scan finding or imaging in our patients was ground- glass & two-sided peripheral spreading. Current study had been similar to previous report that showed that ground -glass was a chief chest CT scan findings in COVID-19¹³.

However, It is worth noting that a small number of COVID 19 patients in our current study did not have CT scan abnormal change and this is consistent with a previous study that showed that 11.5% of patients with confirmed infection with this disease showed normal chest CT scan finding¹³, so we conclude that a CT scan

finding alone is not sufficient to fully exclude reliable and confirmed diagnosis of COVID 19, especially in the early stage of the disease .

Recent study that showed consolidation imaging not characteristic for COVID-19 pneumonia, these result was disagreement with the results reported by Pan et al.⁶⁾ & Xie et al.⁷⁾ that exhibited imaging consolidation as a characteristics for COVID–19 pneumonia.

The current study were consistent with the findings of previous report that showed crazy–paving patterns & diffuse– distribution had been characteristic for CT findings of COVID–19 pneumonia^{14).}

Results of current study also in agreement with the result reported by previous study that demonstrate chest CT scan imaging are frequently normal in initial disease phases; nevertheless, it might demonstration bilateral–infiltrates & ground–glass opacity in initial disease phases^{15).}

Results of the hematological finding in preset study was in agreement with results of previous study the presented varying degrees of laboratory abnormalities e.g. leukopenia, leukocytosis, lymphopenia among COVID–19 & non–COVID–19 such as leukopenia, leukocytosis & lymphopenia etc^{15).}

Laboratory findings might be applied as an supplementary diagnostic tool simultaneously with chest CT scan, it acts mostly on lymphocytes which decrease during COVID–19 but it still normal in non–COVID–19^{11,16).}

We suggested that current research on CT scan findings and imagines have highlighted the chest CT scan role in pandemic COVID–19 diagnosis. Researches with big sample size & clear chest CT scan findings or imagines from different countries are required to guide usage of this tool in the COVID–19 diagnosis.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq.

Conflict of Interest: Non

Funding: Self-funding

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